



# Workshop on a Transatlantic Research Agenda: Future Challenges in Embedded Systems Design

Welcome and U.S. Charge

Helen Gill, Ph.D.  
Program Director  
CISE/CNS  
National Science Foundation



# Meeting Purpose

- Welcome
- NSF Aims for this meeting
  - Working meeting and preliminary review of outcomes from FY 2004 joint EU-US (ITR-FP6) supplement program
    - Precursor to review meeting, Ljubljana, Slovenia, October 20
    - Community-building, interaction, research progress
  - Identify gaps and challenges, emerging community perspective on:
    - Essential transatlantic scientific and technical themes
    - Structural, collaboration frameworks
  - Brainstorm strategies for subsequent EU-US interactions in Embedded Systems (ES)
    - Technical foci, key challenge areas
    - Collaboration, new programmatic strategies



# Importance of Collaboration

- Global challenge areas: common interest, large problems
- Progress, NSF perspective – 5 Embedded Systems (of 11) FY 2004 supplement awards:
  - NSF 0443881 (HiPEAC), Liviu Iftode, Rutgers Univ New Brunswick  
*Cooperative Computing for Distributed Embedded Systems*
  - NSF 0443963 (DECOS), Kane Kim, U of Cal Irvine/Vanderbilt  
*TADE - Timeliness-Assured Design Environment for Distributed Object-Based Embedded Computing*
  - NSF 0443894 (HiPEAC), Margaret Martonosi, Princeton University  
*Designing "Real-Power" Systems: Static and Dynamic Techniques for Managing Power/Performance Tradeoffs*
  - NSF 0443848 (RUNES), Richard Murray, Cal Tech/ U Cal Berkeley  
*Packet-Based Control Theory for Reconfigurable Ubiquitous Networked Embedded Systems*
  - NSF 0443927 (DECOS, ARTIST2), Shankar Sastry, UC Berkeley/Vanderbilt  
*Foundations of Hybrid and Embedded Software Systems*



# Setting a Vision for Embedded Systems, “Grand Challenges”

- Medical devices and systems **of the future**
  - **Now**: Practitioner closes the loop; sensor feeds to TV monitor, manual settings
  - **Future**: Closed-loop patient monitoring and delivery systems, “plug and play” operating rooms/ICUs/home care
- Flight-critical aviation systems **of the future**
  - **Now**: Federated designs, pilot closes the loop
  - **Future**: Integrated designs; autonomy vs. pilot control
- SCADA systems **of the future**
  - **Now**: Telemetry, sensor feeds to control center, centralized decision support
  - **Future**: Hierarchical, decentralized, highly-automated, market/policy driven, closed-loop + supervisory control

**Now: Information-centric, human-closes-loop, distributed a priori, soft real-time, not secured**

**Future: Feedback control, open and hierarchical supervisory control, mobile, aggregated, soft and hard real-time, secured**



# US Inter-Agency (NSTC) Research Coordination – Changes

- Networking & IT R&D (NITRD) Subcommittee
  - New Interagency Working Groups (IWG)
    - High End Computing (HEC)
    - Computer Security and Information Assurance (CSIA)
  - Coordinating Groups (CGs)
    - High Confidence Software and Systems (HCSS)
    - Software Design and Productivity (SDP)
    - Large Scale Networking (LSN)
    - ...
- Critical Infrastructure Protection (CIP) Subcommittee
  - Critical Information Infrastructure Protection (CIIP) IWG
    - Cyber security
    - Cyber infrastructure for physical systems
  - Physical Structures and Systems (PSS) IWG



## High Confidence Software and Systems Update

- HCSS roadmapping activities for key ES “grand challenge” areas:
  - Medical Devices and Systems
    - High Confidence Medical Device Software and Systems (HCMDSS) Workshop, Philadelphia, June 2-3,  
<http://www.cis.upenn.edu/hcmdss/index.php3>
  - Flight-critical systems and aviation safety workshops
  - Critical Infrastructure Protection/SCADA/power grid workshops
    - US Interagency planning workshops
    - EU-US workshop (planning: Zurich, October?)
- National Coordination Office/HCSS information gathering process
  - OS/VM/MW, systems technologies
  - Design and assurance technologies
- Joint EU-US CIP workshop, SCADA
  - US internal process underway
  - Proposed timing: Late March, 2006



## This Meeting: EU-US Linkage, Status Check

- US NSF internal coordination view: Embedded Systems was the largest area of EU-US collaboration in FY 2004
- This meeting should foster any needed changes, enable US report:
  - Technical results
  - Technical challenges and obstacles
  - Structural/logistic/programmatic progress
  - Structural/logistic/programmatic challenges and obstacles
- Greatest importance for today -- develop ideas, strategies that can:
  - Advise future joint actions
  - Shape activities within the venues that develop



# Next Steps?

## FY 2005 ITR Round, Potential Venue

- US deadline: ITR-FP6 Supplement proposals due July 15, 2005
  - Eligibility restriction: new participants
  - Please encourage collaborators in embedded systems
  - ITR funds now finding new venues: Cyber Trust, Science of Design, ..., disciplinary program areas
- NSF Office of International Science and Engineering (OISE) Partnerships program, NSF 05-533
  - Enable larger, sustained US-side collaborative structure, more intensive exchange (5-10 awards)
  - See [www.nsf.gov](http://www.nsf.gov); Program Area: International; follow Partnerships link
  - OISE Briefing highlights (TBD, afternoon session?)
  - Promising venue for embedded systems?





# Slovenia Meeting

- Purpose: assessment of current linkage process:
  - External review committee
    - Tariq Samad, Bruce Krogh – Embedded Systems
    - Ken Kraemer -- eBusiness
    - Val Gregg -- eGovernment
    - Nosh Contractor -- eHealth
  - 1-day meeting (agenda below will expand)
- Current agenda (draft session structure, focus questions):
  - What has been your biggest success to date in terms of joint collaboration, and how did you achieve it?
  - What has been your biggest challenge to date and what are the barriers that are proving to be the most difficult and which are stopping you from getting where you need or want to be?
  - What is your one most important lesson learned or best practice you would like to share with the group? What could NSF or the DG Information Society and Media do to improve things?



Thank You  
Looking forward to a productive day!



# Backup



# Organization: NSF Today

Office of the Director

BIO

ENG

MPS

CISE

EHR

SBE

GEO

Offices

Computer and Information  
Science and Engineering

Office  
of the  
Assistant  
Director

Computing and  
Communications  
Foundations  
(CCF)

Computer and  
Network  
Systems  
(CNS)

Information and  
Intelligent  
Systems  
(IIS)

Shared  
Cyberinfrastructure  
(SCI)